

2-2

Point-Slope Form

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CRITIQUE & EXPLAIN

Paul and Seth know that one point on a line is (4, 2) and the slope of the line is -5. Each student derived an equation relating x and y .

Paul	Seth
$y = mx + b$	$m = \frac{y_2 - y_1}{x_2 - x_1}$
$2 = -5(4) + b$	$-5 = \frac{y - 2}{x - 4}$
$2 = -20 + b$	$-5(x - 4) = y - 2$
$22 = b$	
$y = -5x + 22$	

A. Do the two equations represent the same line? Construct a mathematical argument to support your answer.

Same?

B. **Make Sense and Persevere** Generate a table of values for each equation. How can you reconcile the tables with the equations? © MP.1

Paul $y = -5x + 22$ vs. Seth $-5(x - 4) = y - 2$ (from slope formula)

Paul	Seth																
<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tr> <td>0</td> <td>$-5(0) + 22 \rightarrow 22$</td> </tr> <tr> <td>1</td> <td>$-5(1) + 22 \rightarrow 17$</td> </tr> <tr> <td>2</td> <td>$-5(2) + 22 \rightarrow 12$</td> </tr> </table>	x	y	0	$-5(0) + 22 \rightarrow 22$	1	$-5(1) + 22 \rightarrow 17$	2	$-5(2) + 22 \rightarrow 12$	<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tr> <td>0</td> <td>$-5(0 - 4) = y - 2 \rightarrow 22$</td> </tr> <tr> <td>1</td> <td>$-5(1 - 4) = y - 2 \rightarrow 17$</td> </tr> <tr> <td>2</td> <td>$-5(2 - 4) = y - 2 \rightarrow 12$</td> </tr> </table>	x	y	0	$-5(0 - 4) = y - 2 \rightarrow 22$	1	$-5(1 - 4) = y - 2 \rightarrow 17$	2	$-5(2 - 4) = y - 2 \rightarrow 12$
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HABITS OF MIND

Model With Mathematics How could you represent the equations to show they are equivalent? Explain. © MP.4

$y = mx + b$ ← Slope-Intercept Form

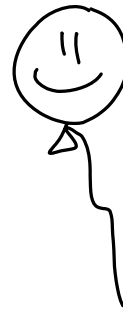
$m = \frac{y_2 - y_1}{x_2 - x_1}$
 (x_1, y_1) : point-slope form
 $y - y_1 = m(x - x_1)$ form

$$y - y_1 = m(x - x_1)$$

EXAMPLE 1 Try It! Understand Point-Slope Form of a Linear Equation

1. Describe the steps needed to find the y-intercept of the graph using point-slope form.

⋮



EXAMPLE 2 Try It! Write an Equation in Point-Slope Form

2. Write an equation of the line that passes through (2, -1) and (-3, 3).

$$y - y_1 = m(x - x_1)$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - (-1)}{-3 - 2} = \frac{4}{-5}$$

$$\rightarrow y - \boxed{-1} = \frac{4}{-5} (x - \boxed{2})$$

$$\rightarrow \boxed{y + 1 = -\frac{4}{5}(x - 2)}$$

$$\text{or } \boxed{y - 3 = -\frac{4}{5}(x + 3)}$$

← same

ex 2)
 w/ slope of $\frac{1}{2}$
 passes through $(3, -2)$ ← (x_1, y_1)

$$y - y_1 = m(x - x_1)$$

$$y - -2 = \frac{1}{2}(x - 3)$$

or

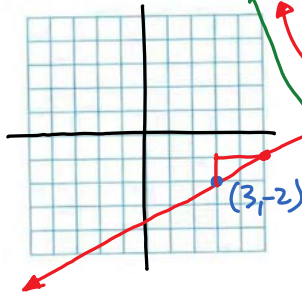
$$\boxed{y + 2 = \frac{1}{2}(x - 3)}$$

HABITS OF MIND

Generalize Explain why the equation of a vertical line cannot be written in point-slope form. © MP8

EXAMPLE 3 Try It! Sketch the Graph of a Linear Equation in Point-Slope Form

3. Sketch the graph of $y + 2 = \frac{1}{2}(x - 3)$.



$$y - y_1 = m(x - x_1)$$

slope $\rightarrow \frac{1}{2}$

$x_1: 3$

$y_1: -2$

$$y - (-2) = \frac{1}{2}(x - (3))$$

Point (x_1, y_1)
 $(3, -2)$

EXAMPLE 4 Try It! Apply Linear Equations

4. Rewrite the point-slope form equation from Example 4 in slope-intercept form. What does the y-intercept represent in terms of the situation?

$$y + 2 = \frac{1}{2}(x - 3)$$

$$y = \frac{1}{2}(x - 3) - 2$$

$$y = \frac{1}{2}x - \frac{3}{2} - \frac{2 \cdot 2}{1 \cdot 2}$$

$$y = mx + b$$

$$y = \frac{1}{2}x - \frac{3}{2} - \frac{4}{2}$$

$$y = \frac{1}{2}x - \frac{7}{2}$$

graph crosses y-axis

HABITS OF MIND

Make Sense and Persevere When is it appropriate to write the equation of a line in point-slope form rather than in slope-intercept form? © MP.1

- pt
- slope

$$y - y_1 = m(x - x_1)$$

- slope
- y-int

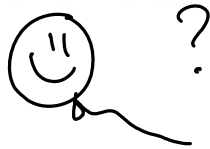
$$y = mx + b$$

Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** What information does the point-slope form of a linear equation reveal about a line?

- slope of line
- (x_1, y_1) : point

2. **Use Structure** If you know a point on a line and the slope of the line, how can you find another point on the line? © MP.7



$$y - y_1 = m(x - x_1)$$

3. **Error Analysis** Denzel identified $(3, 2)$ as a point on the line $y - 2 = \frac{2}{3}(x + 3)$. What is the error that Denzel made? © MP.3

$$x_1 = -3$$

4. **Generalize** You know the slope and one point on a line that is not the y-intercept. Why might you write the equation in point-slope form instead of slope-intercept form? © MP.8

requires y-intercept

Do You KNOW HOW?

Write the equation of the line in point-slope form that passes through the given point with the given slope.

5. $(1, 5); m = -3$ 6. $(-4, 3); m = 2$

$$y - 5 = -3(x - 1) \quad \left| \quad y - 3 = 2(x - (-4))$$

$$y - 5 = -3(x - 1) \quad \left| \quad y - 3 = 2(x + 4)$$

Write an equation of the line in point-slope form that passes through the given points.

7. $(4, 2)$ and $(1, 6)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - 2}{1 - 4} = \frac{4}{-3}$$

$$y - 2 = \frac{4}{-3}(x - 4)$$

OR

$$y - 6 = \frac{4}{-3}(x - 1)$$

8. $(-2, 8)$ and $(7, -4)$

$$m = \frac{-4 - 8}{7 - (-2)} = \frac{-12}{9} = -\frac{4}{3}$$

$$y - 8 = -\frac{4}{3}(x + 2)$$

OR

$$y + 4 = -\frac{4}{3}(x - 7)$$

9. Write the equation $y - 6 = -5(x + 1)$ in slope-intercept form.

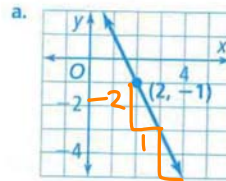
$$y - 6 = -5(x + 1) + 6$$

$$y = -5x - 5 + 6 + 6$$

$$y = -5x + 1 + 6$$

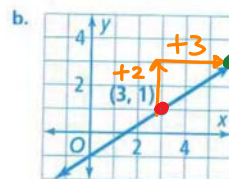
$$y = -5x + 7$$

10. Write the equation of the line in point-slope form.



$$y - (-1) = -5(x - 2)$$

$$y + 1 = -5(x - 2)$$



$$y - 1 = 1(x - 3)$$

$$y - 1 = \frac{1}{3}(x - 3)$$